

# Very Low-Cost, Rugged, High-Vacuum System for Mass Spectrometers, Phase II

Completed Technology Project (2009 - 2012)



## Project Introduction

NASA, the DoD, DHS, and commercial industry have a pressing need for miniaturized, rugged, low-cost, high vacuum systems. Recent advances in sensor technology at NASA and other government laboratories, in academia, and in industry have led to the development of very small mass spectrometer detectors, as well as other analytical instruments needing high vacuum, such as scanning electron microscopes. However, the vacuum systems to support these sensors remain large, heavy, and power hungry. To meet this need, Creare proposes to build a miniaturized vacuum system based on a very small, rugged, and inexpensive-to-manufacture, molecular drag pump (MDP). The MDP is enabled by the development of a miniature, very high-speed (200,000 RPM), rugged, low-power, brushless, DC motor which will be optimized for wide temperature operation and long life during this project. The vacuum pump has performance that is well matched to the needs of the new generation of miniature analytical instruments. The pump represents an order-of-magnitude reduction in mass, volume, and cost over current, commercially available, state-of-the-art vacuum pumps. The new pump will form the heart of a complete vacuum system optimized to support analytical instruments in terrestrial applications as well as on spacecraft and planetary landers. Furthermore, the miniature high-speed motor will be designed so that it can be used in a wide range of high vacuum pumps, including pure molecular drag, pure turbomolecular, and hybrid turbomolecular/molecular drag pumps that can be tailored to the requirements of specific missions and applications.

## Anticipated Benefits

Potential NASA Commercial Applications: Numerous commercial applications exist for the proposed rugged, low-cost vacuum system, primarily to support portable analytical instruments such as mass spectrometers and leak detectors. Current-generation devices are limited by the size and mass of their high vacuum and rough pumps, or else use less capable absorption pumps. Building a small, lightweight, rugged, low-cost, and low power high vacuum system whose performance is tuned to the needs of miniature detectors is expected to greatly expand the market for such devices. The pump technology to be developed under this proposal will be used in instruments being developed by one of our partners in portable mass spectrometers for use by the Department of Homeland Security and the Defense Threat Reduction Agency.



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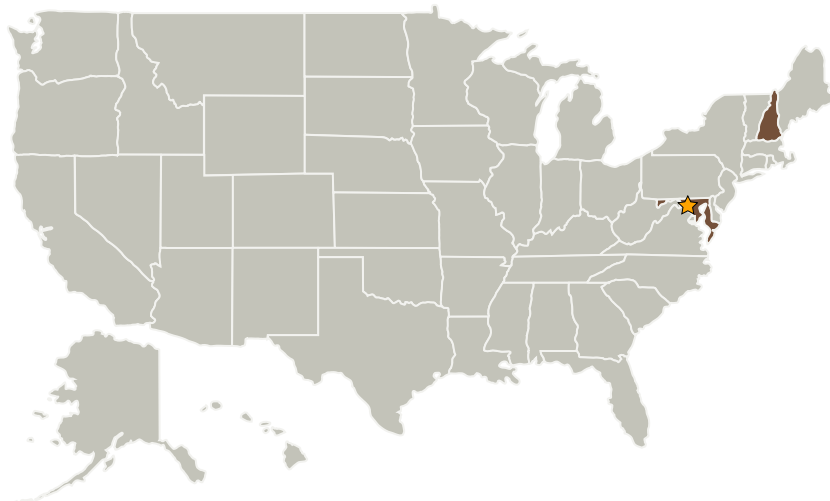
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Creare LLC	Supporting Organization	Industry	Hanover, New Hampshire

Primary U.S. Work Locations	
Maryland	New Hampshire

## Project Transitions

**February 2009:** Project Start

**July 2012:** Closed out

**Closeout Summary:** Very Low-Cost, Rugged, High-Vacuum System for Mass Spectrometers, Phase II Project Image

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Goddard Space Flight Center (GSFC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

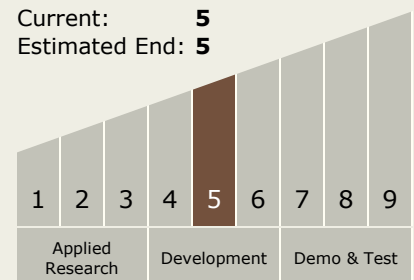
Carlos Torrez

### Principal Investigator:

Robert J Kline-schoder

## Technology Maturity (TRL)

Start: **5**  
Current: **5**  
Estimated End: **5**



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## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.1 Detectors and Focal Planes